Unit 01: The Design Loop and CADD

Content Area: **Applied Technology**
Course(s):
Time Period: **Marking Period 1**
Length: **3 weeks**
Status: **Published**

Summary

Introduction

Unit 1 is designed to address AutoCAD skill gaps and provide students with fundamental problem solving skills using the design loop. Students will design a house to meet this goal. This unit is a formative assessment of student skills, and addresses the different prerequisites and time lapses students will have.

CCSS.Math.Content.HSN-Q.A	Reason quantitatively and use units to solve problems.
CCSS.Math.Content.HSN-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
CCSS.Math.Content.HSN-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
CCSS.Math.Content.HSN-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
MA.A-APR	Arithmetic with Polynomials and Rational Expressions
SCI.HS-ETS1	Engineering Design
SCI.HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
SCI.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
SCI.HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
SCI.HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
CS.9-12.ED	Engineering Design
CS.9-12.NT	Nature of Technology
CS.9-12.ETW	Effects of Technology on the Natural World
CS.9-12.ITH	Interaction of Technology and Humans
CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
SCI.9-12.HS.ED	Engineering Design
SCI.9-12.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
SCI.9-12.HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
SCI.9-12.HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and

	aesthetics, as well as possible social, cultural, and environmental impacts.
SCI.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
SCI.HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
SCI.HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
SCI.HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
WRK.9.2.12.CAP	Career Awareness and Planning
WRK.9.2.12.CAP.2	Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
WRK.9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.
CAEP.9.2.12.C	Career Preparation
CAEP.9.2.12.C.1	Review career goals and determine steps necessary for attainment.
CAEP.9.2.12.C.2	Modify Personalized Student Learning Plans to support declared career goals.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.
TECH.8.1.12.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.12.A.1	Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.
TECH.8.1.12.A.CS1	Understand and use technology systems.
TECH.8.1.12.A.CS2	Select and use applications effectively and productively.
TECH.8.1.12.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.
TECH.8.1.12.B.CS2	Create original works as a means of personal or group expression.
TECH.8.1.12.F	Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
TECH.8.1.12.F.CS1	Identify and define authentic problems and significant questions for investigation.
TECH.8.1.12.F.CS2	Plan and manage activities to develop a solution or complete a project.
TECH.8.1.12.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.
TECH.8.2.12	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.
TECH.8.2.12.A	The Nature of Technology: Creativity and Innovation: Technology systems impact every aspect of the world in which we live.
TECH.8.2.12.A.1	Propose an innovation to meet future demands supported by an analysis of the potential full costs, benefits, trade-offs and risks, related to the use of the innovation.
TECH.8.2.12.A.2	Analyze a current technology and the resources used, to identify the trade-offs in terms of availability, cost, desirability and waste.
TECH.8.2.12.A.3	Research and present information on an existing technological product that has been repurposed for a different function.

TECH.8.2.12.A.CS1	The characteristics and scope of technology.
TECH.8.2.12.A.CS2	The core concepts of technology.
TECH.8.2.12.A.CS3	The relationships among technologies and the connections between technology and other fields of study.
TECH.8.2.12.B	Technology and Society: Knowledge and understanding of human, cultural and society values are fundamental when designing technology systems and products in the global society.
TECH.8.2.12.B.2	Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and maintenance of a chosen product.
TECH.8.2.12.B.3	Analyze ethical and unethical practices around intellectual property rights as influenced by human wants and/or needs.
TECH.8.2.12.B.CS2	The effects of technology on the environment.
TECH.8.2.12.B.CS3	The role of society in the development and use of technology.
TECH.8.2.12.B.CS4	The influence of technology on history.
TECH.8.2.12.C.3	Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics).
TECH.8.2.12.C.4	Explain and identify interdependent systems and their functions.
TECH.8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
TECH.8.2.12.C.6	Research an existing product, reverse engineer and redesign it to improve form and function.
TECH.8.2.12.C.CS2	The application of engineering design.
TECH.8.2.12.C.CS3	The role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.
TECH.9.4.12.CI	Creativity and Innovation
TECH.9.4.12.CT	Critical Thinking and Problem-solving
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
TECH.9.4.12.TL	Technology Literacy
	There are strategies to improve one's professional value and marketability.
	Engineering design is a complex process in which creativity, content knowledge, research, and analysis are used to address local and global problems. Decisions on trade-offs involve systematic comparisons of all costs and benefits, and final steps that may involve redesigning for optimization.
	Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints.

Essential Questions/Enduring Understandings

Essential Questions:

What is the architectural design loop what are its components?

How do architects design buildings?

What skills are necessary to complete CADD work?

Enduring Understandings:

The architectural design loop is composed of 5 steps and provides a path to completing a design problem.

Architects employ the design loop to efficiently complete a project.

Computer Aided Design and Drafting skills are used to complete work efficiently.

Objectives

Students will know:

that the design loop is a procedure to develop a solution to a problem.

the design loop has 5 steps and what they are: programming, brainstorming/pick-one, schematics, design development, and final documents.

that the design loop moves forward, but is iterative.

Students will be skilled at:

how to create, open, rename, save-as, and save files in different formats for AutoCAD. These formats include: .dwg, pdf, .bak.

how to use commands to efficiently draw, including: line, linetype, polygon, polyline, lineweight, mirror, scale, extend, trim, erase, offset, rectangle, ellipse, arc, and others

how to use the design loop to develop a design

strategies and procedures for the development of a set of drawings, including using plans to generate sections and elevations.

Learning Plan

Students will be provided with a drawing to copy that demonstrates their ability to demonstrate CADD skills.

Readings: Teacher will read excerpts from: "Towards A New Architecture", by Le Corbusier.

Activity: Students will design a house that responds to the criteria in a program. Students will be provided with a virtually flat site. Students will develop drawings using the design loop and the teacher as a critic. The drawings: plans, sections and elevations will be placed into a digital portfolio.

Teacher will guide students and provide feedback and assistance throughout the project. Topical demonstrations will be provided to address learning gaps and present new instruction.

Personalized evaluations: teacher to target specific learning goals to remediate skill deficits.

Students will present the project from the digital portfolio and it will be graded using a rubric.

Complete word prompts: "What is the design loop and how did you use it in this project?"

Assessment

Formative assessment:
Students will be provided with a drawing to copy that demonstrates their ability to demonstrate CADD skills.
Exit Tickets
Class Discussion and Feedback

Summative assessment:
Students will present the project from the digital portfolio and it will be graded using a rubric.

possible word prompts: "What is the design loop and how did you use it in this project?", "What is meant by form follows function?"

:Personalized evaluations: teacher to target specific learning goals to remediate skill deficits.

Benchmark Assessment:
Final Exam

Alternative Assessment:
Design loop project/presentation

Note: these assessments may be merged with those in another unit.

Materials

The CADD LAB-computers equipped with up-to-date AutoCAD and/or other design and drafting software, presentation software, productivity software, a scanner and printers/plotters.

Traditional drafting equipment and supplies-vellum, colored and graphite pencils, pen and ink, drawing boards, tape, scissors, t-squares, triangles etc.

Chip-board, X-acto knives and other model making supplies.

A computer with INTERNET based presentation software (i.e. Prezi and Google Slides) and Microsoft Powerpoint.

Smartboard for demonstrations by the teacher and presentations by students.

Integrated Accommodation and Modifications Spec Ed, ELL, At-Risk, G&T, Career Education, 504's

See the linked document for Integrated Accommodation and Modifications, Special Education, English Language Learners, At-Risk, Gifted and Talented, Career Education and 504s.